III. Remarks

This is a response to the official communication mailed in this application on May 28, 2004. The Examiner's careful attention and suggestions are appreciated.

Reexamination and reconsideration is requested.

A. The requirement for restriction

The Examiner required restriction between Group I, claims 1-2, directed to a surface, and Group II, claims 3-23, directed to a method, noting that the inventions were in different classes and that the process may produce other products and that the product may be made by other processes. Applicant elects the claims of Group II, now including claim 25, dependent on claim 6 relating to a cerium example, claim 26 relating to an example shown in Figure 2A, and claim 27 relating to an example shown in Figure 1A. Applicant conditionally traverses the requirement because Group I claim 24 [replacing claim 1] and Group I claim 2, as now amended, describe a product made by the method of claims 3, 4 and 5 and therefore should be proper for inclusion in this application when method claims of Group II are allowed.

The bases of the rejections stated in the official communication are discussed below:

B. Claim objections

In claims 6-23, in line 1, "in which" is changed to --wherein--. The appropriate corrections are made.

C. Other Amendments

Incidental clarifying amendments to the claims have also been made to provide more concise reference to antecedents and to better define the invention. As noted, claim 25, dependent on claim 6, is added; and claims 26 and 27 relating to the examples shown in Figure 2A and Figure 1A are added.

D. **Claim Rejections - 35 USC § 102(b):** Claims 3-5, 9-12, 15-20, and 23, based on Tsou (US Pat. 5,645,930)

As claims 3-5, 9-12, 15-20, and 23 are amended, the claims describe a method in which a powder mixture of large size particles of metal hydroxides, carbonates, or nitrates and a noble metal, noble metal hydroxide, carbonate, or nitrate is thermal sprayed directly onto the surface of a substrate and the materials in the powder sprayed decompose by pyrolosis to small size oxide and noble metal particles that bond to the substrate surface. "Particle," "granule" and "powder" all refer to like states of matter of particulate compositions.

While Tsou mentions thermal spraying, Tsou does not describe the pyrolosis or decomposition that occurs wherein large size powder precursors selected from the group of metal hydroxide, metal carbonate, metal nitrate, noble metal, noble metal hydroxide, noble metal carbonate, and noble metal nitrate are directed to a surface in a thermal spray, and in the process, are chemically or physically transformed into small size particles that bond to the surface as a catalyst.

The Examiner notes that Tsou references small size particles; Tsou, however, does not produce small particles by the pyrolosis or decomposition of large particles by thermal spraying [Specification, *passim*. *See also* Paragraphs [0010], [0021], [0031], [0030] (a phase transition in cerium compositions), and Figures 3A and 3B]; Tsou is a classic coating process depositing particles on a substrate *as is* in their original form and size; Tsou mixes materials in a slurry or otherwise applies a mixture, as is, to the substrate. Tsou does not describe the transformation of particles in a thermal spray as now pointed out more particularly in independent claims 3-5 and dependent claims 9-12, 15-20, and 23.

Tsou, accordingly, does not describe or anticipate the method of the amended claims.

D. **Claim Rejections - 35 USC § 103**: Claims 6, 13 and 14 in view of Tsou (US Pat. 5,645,930) and Subramanian (US Pat. 6,387,539 B1).

Amended independent claims 3-5 have been distinguished over Tsou as pointed out above.

The relevance of Subramanian is questionable. The claimed invention is a method in which thermally sprayed particles undergo a transformation through pyrolosis to produce small size oxide and noble metal particles that bond to the substrate surface to produce a catalyst coating; Subramanian provides a classic barrier coating, not a catalyst coating of small size metal oxide and noble metal particles; Subramanian is directed to an pyrochlore molecular structure in a barrier coating as an improvement over a prior art fluorite structure. There is no suggestion in a combination of Tsou and Subramanian that using cerium, praseodymium and terbium compositions of dependent claims 6, 13 and 14 would result in the small size particle distribution on the invention, for example, shown in Figures 3A and 3B. Regarding claim 6 and new dependent claim 25, a phase transition resulting in a porous surface occurs in the cerium composition referred to as an example.

E. **Claim Rejections - 35 USC § 103:** Claim 8 in view of Tsou (US Pat. 5,645,930) and Cordy (US Pat. 6,129,996).

Claim 8 relates to the use of a tin hydroxide, carbonate or nitrate in the method of amended claim 4 or claim 5. Amended independent claims 3-5 have been distinguished over Tsou as pointed out above. The Examiner's mention of abrasion resistance in aluminum pistons, as described ion Cordy, does not suggest the method now described in claim 8 wherein large size thermally sprayed particles of a tin hydroxide, carbonate or nitrate undergo a transformation through pyrolosis to produce small particles that bond to the substrate surface, useful, for example, as a catalytic surface in a micro component device for laminar fluid flow as described in the present Specification [Paragraph [0008]] in contrast with a piston coating.

F. **Claim Rejections - 35 USC § 103:** Claim 21 in view of Tsou (US Pat. 5,645,930) and Beaver (US Pat. 4,871,703)

Claim 21 depends on amended claim 4 or amended claim 5 wherein the hydroxide, carbonate, or nitrate particle is a gold composition. Beaver's electrocatalytic salt method does not suggest the method now described in claim 21 wherein large size thermally sprayed particles of a tin hydroxide, carbonate or nitrate undergo a transformation through pyrolosis to decompose to small particles that bond to the

substrate surface, useful, for example to produce a catalyst surface in a micro component device [Specification [Paragraph [0008]].

G. Claim Rejections - 35 USC § 103: Claims 7 and 22 in view of Tsou (US Pat. 5,645,930) and Silversand (US Pat. 5,980,843).

Claim 7 depends on amended claim 4 or amended claim 5 wherein the hydroxide, carbonate, or nitrate particle is an aluminum composition. Silversand's method for a nitric acid or flue gas device, does not suggest the method now described in claim 7 wherein large size thermally sprayed particles of an aluminum hydroxide, carbonate or nitrate undergo a transformation through pyrolosis to decompose to small particles that bond to the substrate surface, useful in a micro component device, in contrast with a flue gas device. The process of Silversand is simply not similar.

Similarly, regarding claim 22, dependent on amended claims 3, 4 and 5, Silversand does not suggest flame spraying large size particles to undergo a transformation through pyrolosis to decompose to small particles that bond to the substrate surface of a catalyst

H. The New Claims 24-27 Added

New claims 24-27 are added. Claim 24 describes a catalytic surface produced in accordance with claim 3 or claim 4 or claim 5 with a coating of substantially uniform size particles of the groups of: a) one or more than one of cerium oxide, aluminum oxide, tin oxide, manganese oxide, copper oxide, cobalt oxide, nickel oxide, praseodymium oxide and terbium oxide particles; and b) one or more than one of ruthenium, rhodium, palladium, silver, iridium, platinum and gold particles, bonded to a substrate wherein the size distribution of the nominal diameters of the particles is in the range of <3 microns. Claim 25 describes the example wherein a cerium powder is introduced into a thermal spray and undergoes a phase transition to produce a porous CeO_2 coating. Claim 26 describes the example of Figure 2A in which the large size particles selected from the group of a metal hydroxide, metal carbonate, and metal nitrate particles and the large size particles selected from the group of a noble metal, noble metal hydroxide, noble metal carbonate, and noble metal nitrate are separately introduced into the thermal spray directed onto the surface. Claim 27 describes the example of Figure 1A in which

the large size particles selected from the two groups are commingled and introduced as a powder mixture into the thermal spray directed onto the surface. As claims 24-27 depend on claims 3, 4 or 5, claims 24-27 are similarly patentably distinguishable over the cited references as pointed out above, and further in their particular specifications set out in this paragraph.

For the foregoing reasons, applicant requests the rejections be withdrawn and that the application, as amended, including claims 2-27 be allowed.

Respectfully submitted,

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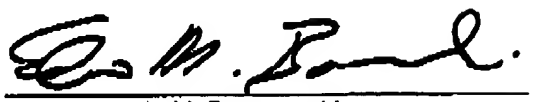
CERTIFICATE OF FILING BY FACSIMILE TRANSMISSION:

I certify that the foregoing AMENDMENT AND RESPONSE TO THE OFFICIAL COMMUNICATION MAILED ON MAY 28, 2004 accompanied by Form PTO SB/22 for a one month extension of time, Form PTO/SB/06 Fee Determination; Authorization re Deposit Account, and Transmittal Form SB/21 are being filed by Facsimile Transmission on September 21, 2004 to Group Art Unit 1754, Attention: Examiner Cam N. Nguyen.

Facsimile Number 703/872-9306 [Commissioner for Patents, Mail Stop Amendment, PO Box 1450, Alexandria, Virginia 22313-1450].



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In the application:

Application Number: 09/912,223

Inventor: HE, Ting

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For: SUBSTRATES WITH SMALL PARTICLE SIZE METAL OXIDE AND NOBLE METAL CATALYST COATINGS AND THERMAL SPRAYING METHODS FOR PRODUCING THE SAME

Group Art Unit: 1764
Examiner: Cam N. Nguyen

Atty. Docket No.: 3994994-131915-2